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PANOPEA ABBREVIATA (BIVALVIA: HIATELLIDAE) IN THE SOUTHWESTERN ATLANTIC OCEAN, TAXONOMIC REVISION AND ANATOMY

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ABSTRACT

The taxonomy and anatomy of the southwestern Atlantic geoduck, Panopea abbreviata Valenciennes, 1839, are revised. Materials from several institutions, as well as new living specimens collected from the coast of Argentina were studied. Type materials of all related nominal species are illustrated. The shell morphology, shell ultrastructure, hinge, ligament and mantle cavity organs are described. The symbiotic relationship with the nemertean Mala-cobdella arrokeana, attached to host mantle tissues, is mentioned. Panopea abbreviata is abundant in the gulfs of northern Patagonia. It occurs in the subtidal zone from 8 to 25 meters deep, deeply buried in the sediment. It has a large thick shell, shortener at the posterior end, with exposed siphons covered by a dark brownish periostracum; a hinge plate characterized by a single cardinal tooth in each valve; and shell ultrastructure with three layers: an outer layer of nearly vertical and composite prisms, a middle, true homogeneous layer, and an inner layer of alternating sublayers of fine complex crossed lamellar and irregular simple prisms. The fused mantle is only interrupted in the pedal gape. Ctenidia and labial palps association belongs to the Category Ill and ctenidia type C(1). Panopea antarctica is its only synonym. The fossil taxa Panopea truncata, P. inferior, P. hauthali, P. coquimbensis and P. guayacanensis
are excluded from the synonymy.
Key words: Panopea, Argentina, taxonomy, anatomy, Hiatellidae.

INTRODUCTION

The suprageneric arrangement of the family
Hiatellidae Gray, 1824, was revised by Carter et
al. (2011), in which the new Order Hiatellida was
introduced to group the superfamilies Edmon-
dioidea W. King, 1850, and Hiatelloidea J. Gray, 1824. Other phylogenetic analyses confirm the relationship of Hiatellidae with the Solenidae and Pharidae (Solenoidea) as a sister group, and excludes it from the Myoida (Adamkewicz et al., 1997; Taylor et al., 2007, among others).
Nine genus-level names were included as valid in the Hiatellidae by Keen (1969). Degran-gia Cossmann & Peyrot, 1909, and Panomya Gray, 1857, were considered subgenera of Panopea by Keen. However, they have since been regarded as valid genera (Yonge, 1971; Vaught, 1989; Huber, 2010).
The genus Panopea was introduced by Me-nard de la Groye (1807). An historical review of this genus was carried out by Dall (1912). He reviewed the previous illustrations of this genus

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from Aldrovandus in 1606 to Menard de la Groye
in 1807, who finally gave the name of Panopea aldrovandi to the Mediterranean species. Dall (1912) mentioned that Panope, published in a separate “Mémoire”, should be accepted instead Panopea, published in the Annales du Museum d'Histoire Naturelle. This taxonomic issue was submitted to the International Commission on Zoological Nomenclature by Vokes & Cox (1961), and almost 25 years after their proposal, the ICZN ruled the correct name to be Panopea (ICZN, 1986; Opinion 1414).
Other members oft his genus have been stud-ied in different parts of the world. In the northeast Pacific Ocean, several aspects of the biology of P. generosa, such as, functional morphology, ecology, morphometry, aquaculture and taxo-nomic reviews have been carried out (Bower & Blackbourn, 2003; Feldman et al., 2004; Fisher et al., 2008; Goodwin & Pease, 1991; Rocha Olivares et al., 2010; Marshall et al., 2012; Leyva-Valencia et al., 2012). In some publica-tions, the name Р abrupta (Conrad, 1849) was

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considered as valid, with P generosa regarded
as a junior synonym. However, Vadopalas et
al. (2010) recognized the Recent Р. generosa
as valid and excluded it from the synonymy of
Conrad's fossil species. Arambula-Pujol et al.
(2008) studied the reproductive biology of Pano-pea globosa (Dall, 1898) in the Gulf of California. The functional morphology of several species of this family was studied by Yonge (1971). Along the southwestern Atlantic Ocean, the family Hiatellidae is represented by about 14 species (Carcelles, 1944; Carcelles & William-son, 1951; Castellanos, 1970; Abbott 8 Dance, 1986; Scarabino, 2003; Rios, 2009), but only one species of Panopea is commonly cited. The geoduck Panopea abbreviata (Valenciennes, 1839) is an endemic species well represented all along the Argentine coast (Carcelles, 1944; Carcelles & Williamson, 1951; Castellanos, 1970). It was mentioned by Bernard (1983) as occurring in the Pliocene and as the senior synonym of several species described from the fossil record of Chile and Argentina.
In recent years, this species has been studied as a possible target of artisanal fisheries in north Patagonia (Ciocco et al., 2001; Morsán & Ciocco, 2004; Narvarte & Filippo, 2007; Morsán et al., 2010). The reproductive cycle of P. abbreviata was studied by Van der Molen et al. (2007) and Zaidman et al. (2012). The de-velopment of these fisheries allowed the study of biological interactions between the geoduck and other organisms. The most studied has been the presence of the symbiotic nemertean Malacobdella arrokeana Ivanov, Bigatti, Pen-chaszadeh & Norenburg, 2002, in its mantle cavity (Ivanov et al., 2002; Martorelli et al., 2003; Vázquez et al., 2009, 2010; Teso et al., 2006; Alfaya et al., 2013). In addition, a new species of flat worm (Platyhelminthes) living in the in-testine of P abbreviata was recently described (Brusa et al., 2011). During an ongoing study of genetics, population structure and reproduction of the nemertean Malacobdella arrokeana the taxonomic revision and anatomical description of Panopea abbreviata was carried out. In addi-tion, the type material of related nominal species was illustrated.

MATERIALS AND METHODS

Living specimens were collected by scuba diving at 20 m from San Jose gulf (42*24"11”S, 6417"10”W) (Fig. 1). The microstructure of the valves was analyzed with a scanning electron microscope (JEOL JSM-6460LV, Aluar S.A).

The outer shell layer was revealed at posterior shell margin radial section, the middle layer just exterior to the pallial line and the inner layer in the umbonal region. All shell sections were polished with 500 grit sandpaper followed by 1,000 grit sandpaper, then etched the surfaces with 2% hydrochloric for 40 seconds. All type material and additional specimens studied are deposited in the following institutions: Centro Nacional Patagónico (CNP-Inv), Museo Ar-gentino de Ciencias Naturales “Bernardino Rivadavia” (MACN-In), Buenos Aires; Museo de la Plata (МЕР); Museum National d'Histoire Naturelle (MNHN), Paris; Rio Grande do Sul; Museu de Zoologia da Universidade de Säo Paulo (MZUSP) and the National Museum of Natural History, Smithsonian Institution (USNM), Washington D.C., United States.

Morphological Abbreviations

a anus
aa ascendant arm
aam anterior adductor muscle
cs ctenidial septum
ct cardinal tooth
da descendent arm
dd digestive diverticula
es excurrent siphons
fs fibrous sublayer
f foot
fg food groove
g gonad
hd hindgut
id inner demibranch
ip inner labial palp
IS incurrent siphon
la left auricle
Ic left caecum
Is lamellar sublayer
m mouth
mc mantle cavity
md midgut
od outer demibranch
olp outer labial palp
pam posterior adductor muscle pa papillae
p periostracum
pn pseudonymphal ridge
r rectum
ra right auricle
sa supporting axis
sae supraaxial extension
sps siphonal pallial septum
st stomach
t tentacle
у ventricle

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Rio de Janeiro

D

Valdés Peninsula

Puerto Deseado

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San Matias gulf

San José gulf

FIG. 1. Distribution map of Panopea abbreviata with a detail of collecting localities.

SYSTEMATIC RESULTS

Order Hiatellida Carter, 2011
Superfamily Hiatelloidea J. Gray, 1824
Family Hiatellidae J. Gray, 1824
Subfamily Panopeinae
Bronn, 1862

Genus Panopea Ménard de la Groye, 1807 (p. 135)

[= Glycimeris Lamarck, 1799; type species: Mya glycimeris Born, 1778, by tautonymy (suppressed for the purposes of the Prin-ciple of Priority by the ICZN, 1986; Opinion 1414); Panope Ménard de la Groye, 1807 (nom. null.); Panodea Oken, 1817 (nom. null.); Panopaea Lamarck, 1818 (nom. null.); Myopsis Agassiz 1840; type species: Mya mandibula J. Sowerby, 1813, by the subse-quent designation of Cox, 1964; Heteromya

Mayer-Eymar 1884; type species: Panopea (Heteromya) lessepsi Mayer-Eymar, 1884, by monotypy; Capistrocardia Tate, 1887; type species: Capistrocardia fragilis Tate, 1887, by original designation].

Type species: Panopea aldrovandi Ménard de la Groye, 1807 (= Mya glycimeris Born, 1778), by subsequent designation of Children, 1822. Pliocene-Recent, Europe.

Remarks

Panopea aldrovandi Ménard de la Groye, 1807 (= Mya glycimeris Born, 1778) is regarded as having been fixed as the type species of the genus by the subsequent designation of Children (1822: 84). A few years prior, Flem-ing (1818) designated as type Mya glycimeris Born, 1778, a designation that was accepted by Winckworth (1929) and later by Keen (1969).

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However, the ICZN (1986, Opinion 1414) con-
cluded that Fleming's identification was invalid
because Mya glycimeris Born was not originally
included in Panopea.

Panopea abbreviata
Valenciennes, 1839
(Figs. 2-9)

Panopea abbreviata Valenciennes, 1839: 18, pl. 6, fig. 1a, b; Valenciennes, 1843: pl. 9, fig.1; Lamy, 1925: 276; Castellanos, 1970: 265; Rios, 1975: 253, pl. 80, fig. 1213; 1994: 294, pl. 100, fig. 1433; 2009: 589, fig. 1628; Scarabino, 1977: 214; Lasta eta l., 1998: 130, fig. 5d; Scarabino, 2003: 240; Scarabino et al., 2006: 164.
Panopaea abbrebiata (Valenciennes) — d'Orbigny, 1846: 509; Woodward, 1854: 220; Woodward, 1856: 378; Mayer-Eymar, 1870: 68; Wood-ward, 1870: 87; С. В. Sowerby Il, 1873: pl. 6, fig. 10; Clessin, 1895: 50, pl. 18, fig. 3. Panopaea antarctica Gould, 1850: 214; 1852: 386; 1862: 74; H. Adams &A. Adams, 1856: 350:
Glycimeris abbreviata (Valenciennes) - H. Adams & A. Adams, 1856: 350; Tryon, 1868: 60.
Panope abbreviata (Valenciennes) — Carcelles, 1944: 294, pl. 14, fig. 114; Carcelles & Wil-liamson, 1951: 346; Barattini & Ureta, 1961: 183; Figueiras & Sicardi, 1970: 409.

Type Material: Panopea abbreviata Valenci-ennes, 1839, MNHN 25707, two syntypes (Figs. 2-7); Panopea antarctica Gould, 1850, USNM 17515, holotype (Figs. 8, 9).

Type Locality: Mouth of Rio Negro, Patagonia, Argentina.

Other Material Examined: Brazil — Niteröi, Rio de Janeiro (MZUSP 106418, collected in 1969); Säo Sebastiäo, Barra Velha (MZUSP 189720130); Santa Catarina, Cabo Santa Marta (MZUSP 20131, 137 m depth); Santa Catarina Laguna (MZUSP 32714, 110-130 m depth, collected in 2000). Uruguay — Mon-tevideo (MACN 15187); 85 miles southeast from Puerto La Paloma (MACN 16634). Argentina — Mar Chiquita (MLP 2565); Mar del Plata (MACN 377, 9361, 16688, 10309, 9361-38, 10229, 9154-8, 19162, 9379-14, 29560, 15781; MLP 1879, 2087, 2421, 4889); Puerto Quequén (MACN 21071, 416); Bahia San Blas (MACN 20232); Mouth of Rio Negro

(MACN 20649); San Antonio Oeste (MACN 9379-12, 13345, 13135, 9151-12, 9379-13; MLP 2706; MZUSP 13134); San Matias gulf (MACN 21277); San José gulf (MACN 9175- 24; MLP 2744, 13203); Puerto Piramides, Nuevo gulf (MACN 26442): Punta Norte, Val-dez peninsula (MACN 11492); Punta Ninfas, Nuevo gulf (USNM 869774).

Distribution

From Rio de Janeiro, Brazil, to Nuevo Gulf, Chubut Province, Argentina.

Diagnosis

Shell thick, rounded, large, up to 15 cm, gaping widely at both ends, elongated but pos-teriorly shortened, inflated; external ligament strong; periostracum dark brownish; ultrastruc-ture outer prismatic, middle homogeneous and inner complex crossed lamellar (CCL) layers; cardinal tooth sharp, erect.

Description

Shell: Thick, large, up to 15 cm length, ex-ternally white, surface smooth with irregular growth lines, covered by a thin, yellowish-green periostracum; umbo slightly inflated, prosogy-rate; lunule and escutcheon not defined; antero-posteriorly elongated, but shortened at posterior end, anteriorly rounded, ventral margin rounded and usually eroded; widely gaping at both ends; all exposed siphons and tissues covered by dark brownish periostracum (Fig. 18); internally white, pallial line separated from ventral edge of shell about 1.5 cm, pallial sinus U-shaped, higher than deep; adductor muscle scar clearly visible, the anterior larger; nymphal ridge very prominent at posterior side of hinge; external ligament strong, quasiparivin-cular, wide, dark brown, opisthodetic, on strong pseudonymph, with fibrous sublayers attached to dorsal and lateral surfaces of pseudonymph and covered by the lamellar sublayer (Figs. 10-13); hinge plate characterized by sharp, erect single cardinal tooth in each valve, fitting into corresponding socket in other valve (Figs. 14-17); ultrastructure of the shell with three layers (Figs. 23-28): an outer layer of nearly vertical and composite prisms (Figs. 24, 25), a middle true homogeneous layer of rounded units (Fig. 26) and a complex crossed lamellar inner layer with intercalations of irregular simple prisms (Figs. 27, 28).

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FIGS. 2-9. Panopea spp. FIGS. 2-5: Panopea abbreviata Valenciennes, 1839, MNHN 25707, two syntypes; FIGS. 6, 7: Р abbreviata original illustration; FIGS. 8, 9: Panopea antarctica Gould, 1850, USNM 17515, holotype. Scale bar =2 cm.

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Mantle Cavity Organs: The mantle fusion
is only interrupted at the pedal gape, which is
anteriorly positioned. Inside the large mantle
cavity, two pairs of labial palps surround the
mouth, the inner one longer than wider (Figs.
19, 33); the association of ctenidia and labial palps is Category Ill of Stasek (1963), wherein the ventral tips of the anterior filaments of the inner demibranch are not inserted into the distal

oral groove. However, the anteroventral margin of the inner demibranch is fused to the inner palp lamella. The ctenidia surround the visceral mass laterally (Figs. 29, 30); they belong to type
С (1) of Atkins (1937), characterized by an outer
demibranch with a distinct supra-axial exten-
sion and food groove only present in the inner
demibranch (Fig. 31), the outer demibranch
less deep than the inner. Frontal currents at

FIGS. 10-17. Panopea abbreviata. FIGS. 10-13: External ligament showing fibrous sublayers attached to dorsal and lateral surfaces of pseudonymph covered by lamellar sublayer. Scale bar = 1 cm; FIGS. 14, 15: Right hinge; FIGS. 16, 17: Left hinge.

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both sides of inner demibranch go to the food groove. The oral current is observed along the groove as well as between the bases ofthe two demibranchs on each side of the body. In the outer demibranch, particles are carried ventrally on the ascending lamella and dorsally on the descending lamella (Fig. 31). Ctenidial septum with two rows of perforations that separate the suprabranchial and infrabranchial chambers

(Fig. 32). It is placed posterodorsal to the visceral mass, and behind it is positioned the base of the siphons. A short, anteriorly directed, rudimentary foot is present at the anterior side of
the body (Figs. 29, 30). The adductor muscles
are large, the anterior slightly larger than the
posterior (Fig. 19); siphons large, hypertro-
phied, about two times shell length, completely
covered, together with all pallial surfaces, with

FIGS. 18-22. Panopea abbreviata. FIG. 18: General aspect. Scale bar = 4 cm; FIG. 19: Mantle cavity organs. Scale bar = 4 cm; FIGS. 20—22: Excurrent and incurrent siphons with papillae and short tentacles along the aperture respectively. Scale bar Figs. 20, 22 = 1cm, Fig. 21 = 5 mm.

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a thick, wrinkled, dark brownish periostracum,
near the aperture with symbiotic red algae
(Figs. 20-22); with small papillae along aperture
ring in the excurrent siphon; and with short, ir-
regular tentacles surrounding the apertures in
the incurrent siphon (Figs. 20-22); it belongs to type C of Yonge (1957, 1982) formed by fusion of all surfaces of the inner and middle mantle folds (sensu Yonge, 1982; Carter et al., 2012), evidenced by the posterior position of

the periostracal groove encircling both sipho-nal apertures; siphonal pallial septum strong separating the incurrent and excurrent channels by the fused left and right mantle tissue (Fig. 34). Alimentary canal with a mouth followed
by a short esophagus that enters the stomach
anterodorsally (Figs. 37, 38). The style sac and
the midgut are combined leaving the stomach
ventrally (Fig. 37); the coiled intestine passes
backward through the right side of the visceral

FIGS. 23-28. Shell ultrastructure. FIG. 23: Three layers. Scale bar = 100 um; FIGS. 24, 25: Detail of vertical and composite prisms of outer layer. Scale bar = 100 um and 5 um respectively; FIG. 26: Middle true homogeneous layer. Scale bar = 10 um; FIG. 27: Complex crossed lamellar inner layer. Scale bar = 100 um; FIG. 28: Detail of intercalations of irregular simple prisms in the inner layer. Scale bar = 10 um.

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mass ascending to the pericardial cavity asthe hindgut, then it passes through the heart to end in the rectum and posteriorly in the anus. The stomach of P abbreviata belongs to Type IVa sensu Purchon (1987, 1990) and Carter et al. (2012). The major typhlosole is curved to the left in an incomplete spiral; it goes together with the intestinal groove to its anterior end passing to-wards the left caecum (Fig. 37). Circulatory sys-

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tem pumped by a muscular heart that surrounds the hindgut-rectum placed in a posterodorsal position between visceral mass and posterior
adductor muscle in the pericardial cavity, with
two inflated auricles, dorsally positioned and
one ventral ventricle (Figs. 35, 36).

Symbiosis with Malacobdella arrokeana: The
symbiotic relationship between P. abbreviata

FIGS. 29-38. Anatomy of Panopea abbreviata. FIGS. 29, 30: General aspect showing a sectioned outer demibranch and anus aperture; FIG. 31: Diagrammatic transverse section showing the form of the ctenidia and frontal currents direction (from Atkins, 1837); FIG. 32: Ctenidial septum with two rows of perforations; FIG. 33: outer and inner labial palps; FIG. 34: Siphonal pallial septum strong separating the incurrent and excurrent channels; FIGS. 35, 36: Heart with two auricles and one ventricle surround-ing the hindgut; FIGS. 37, 38: Transversal section of visceral mass showing digestive system.

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and the nemertean M. arrokeana has been
widely studied (Ivanov et al., 2002; Vazquez et
al., 2009; Alfaya et al., 2013). These authors
found that almost all collected specimens of
Panopea (99.4%) were inhabited by the nem-
ertean, which has host specificity, being found only in P. abbreviata. Malacobdella arrokeana, which lives attached by its terminal sucker, is the only member of the genus reported in the southern Atlantic Ocean (Ivanov et al., 2002). The association allows M. arrokeana to obtain food and shelter during its development inside P. abbreviata. Immature nemerteans were observed living attached to the gills laminae.

After its development, the nemertean moves and attaches to the mantle cavity by its terminal sucker. The main food sources for both species are diatoms and small crustaceans.

Habitat

Panopea abbreviata has been collected from
8 to 25 meters, deeply buried, up to 40 cm in
sand and mud substrata rich in organic matter.
It is usually recorded with such other clams as
Ensis macha, Leukoma antiqua and Retrotapes
exalbidus.

FIGS. 39-44. South American fossil taxa of Panopea. FIG. 39: Panopea coquimbensis d’Orbigny, 1843, MNHN 13626, syntypes; FIG. 40: Panopea guayacanensis Philippi, 1887, MNHNC-Pi 247, holotype; FIGS. 41, 42: Panopaea truncata Borchert, 1901, MACN-Pi 2530, holotype; FIG. 43: Panopaea inferior Wilckens, 1907, original illustration; FIG. 44: Panopaea hauthali Wilckens, 1907, original illustration. Scale bar: Figs. 39, 41, 42 = 1 cm; Fig. 40 = 3 cm; Figs. 43, 44 = 2 cm.

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Remarks

Type material examination revealed morpho-logical differences between related nominal species that allow us to update the taxonomic status of P abbreviata. Panopea coquimbensis d’Orbigny, 1843 (p. 126, pl. 15. figs. 7, 8), de-scribed from Tertiary sands around Coquimbo, in northern Chile was incorrectly synonymized with P abbreviata by Bernard (1983). Study of the syntypes deposited at MNHN, represented by internal molds, shows a more elongate shell with a siphonal gap folding outwards more defined and with a pallial sinus V-shaped (Fig. 39). Herm (1969) synonymized Panopea guayacanensis Philippi, 1887 (p. 167, pl. 34, fig. 2) from Guayacan, Chile with d’Orbigny’s species. Griffin & Nielsen (2008), after an examination of type material of both nominal species, confirmed the synonymy proposed by Herm. Panopea guayacanensis, described from Tertiary deposits of Guayacan, was also considered a junior synonym of P. abbreviata by Bernard (1983). The type material of Philippi species coincides with d Orbigny species and clearly differs from the type material of Valenci-ennes (Fig. 40). Panopaea truncata Borchert, 1901 (p. 212, pl. 9, figs. 1, 2), described from Parana Formation, was also synonymized in the literature (Bernard, 1983). The type mate-rial, as well as the original illustration, revealed that Borchert species must be excluded from the synonymy of P. abbreviata (Fig. 41, 42). Panopea truncata shows a more elongate, rectangular shell, with a straight ventral edge. However, its articulated valves do not allow the study of the hinge. In addition, del Rio (1994) considered it to be a junior synonym of P. regularis (Ortmann, 1900). Panopaea inferior (p. 47, pl. 9, fig. 2) and P. hauthali (p. 49, pl. 9, fig. 3), both described by Wilckens (1907), were incorrectly cited as synonyms of P abbreviata by Bernard (1983). The first was described from deposits exposed in Cerro Cazador, Sierra de los Baguales and Cancha Carrera in Santa Cruz Province, and the second from Sierra de los Baguales only. The characters observed in the original illustra-tions of Wilckens clearly differ with those of P abbreviata (Fig. 43, 44 respectively). The type material of both species was not found in the collection of Freiburg, and they probably did not survive to the Second World War (Sven Nielsen, pers. comm.).

DISCUSSION

From six nominal species synonymized in the literature, only the recent P. antarctica Gould, 1850, can be considered a junior synonym of the Valenciennes species. The others are fos-sils names described along southern Patagonia of Argentina and Chile. The stratigraphic range of Miocene-Recent mentioned by Aguirre & Farinati (1999) is incorrect. The Recent geo-duck was never mentioned in various revisions of the fossil mollusks in the Miocene of Argen-tina (Ihering, 1907; Martinez & del Rio, 2002; del Rio, 1992, 1994, 2002, 2004, Griffin, 1991, among others). This is a Quaternary-Recent species, well represented in north patagonian gulfs. The material examined shows a well defined distribution from Rio de Janeiro to Peninsula Valdés. Some lots were found in examined malacological collections from locali-ties beyond this southern limit of distribution. The examination of those materials (MACN 17734; MZUSP 13138) revealed the presence of Panopea aff. abbreviata in Puerto Deseado, Santa Cruz Province, Argentina. After field work that included the localities of Bahia Camarones, Bahia Bustamante, Caleta Sara, Comodoro Rivadavia (Chubut Province), Punta Buque and Puerto Deseado (Santa Cruz Province), living specimens of Р abbreviata were not found. Within this context, the distribution mentioned by Carcelles & Williamson (1951) and Castellanos (1970) is at least uncertain in the southern localities from Peninsula Valdes to Puerto Deseado, as suggested by Alfaya et al. (2013).
The anatomy of this species is similar to other members ofthe genus. The mantle cavity organs observed by Yonge (1971) and Bower & Blackbourn (2003) for the Pacific species P. generosa are similar to those in Р abbreviata. The examined morphology of the stomach of P abbreviata agrees with that observed by Narchi (1973) and Purchon (1958) in Hiatella solida and H. arctica respectively. The shell morphol-ogy allows us to differentiate the valid American species of the genus. Additional morphological revisions of other species of the genus are necessary to understand the conservative morphology of this group of bivalves. Panopea abbreviata Valenciennes, 1839, constitutes together with Panopea bitruncata (Conrad, 1872), the two Recent western Atlantic species of the genus.

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